

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. 91-132

WASTE DISCHARGE REQUIREMENTS
FOR
SAN JOAQUIN REFINING COMPANY, INC.
WASTEWATER INJECTION WELL
KERN COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Board) finds that:

1. San Joaquin Refining Company, Inc., (hereafter Discharger) submitted a Report of Waste Discharge on 28 March 1989 requesting waste discharge requirements. A technical report on the project was submitted on 28 March 1989. Additional information was submitted to complete the technical report on 5 April 1989, 10 May 1990, and 9 October 1990. The property (Assessor's Parcel Nos. 332-040-18) is owned by the Discharger.
2. The Discharger proposes to dispose of refinery wastewater in one deep injection well.
3. The Discharger proposes to discharge a maximum of 0.10 mgd of wastewater from the Discharger's refinery.
4. This Order is being issued in compliance with Division 7 of the Water Code, Sections 13000 through 13999 (Porter-Cologne Water Quality Control Act).
5. The site is within the boundaries of the Fruitvale Oil Field, on the northwest side of Bakersfield, California, within the Tulare Lake Basin of the San Joaquin Valley. The proposed injection well will be at the Discharger's Bakersfield refinery (hereafter Plant) in Sections 23, T29S, R27E, MDB&M, as shown in Attachment A, which is part of this Order. Wastewater generated by the Plant is currently disposed of to an unlined surface impoundment.
6. The Board adopted Order No. 90-087 on 23 March 1990, prescribing waste discharge requirements for the unlined surface impoundment.
7. Topography in the area is flat. Activities in the area are associated with oil field production, refining, and limited industrial operations.
8. The facility lies outside the 100-year flood boundary area according to the Federal Insurance Administrator's "Flood Hazard Boundary Map".

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9. The sedimentary section in the Fruitvale Oil Field ranges in thickness from 8,500 to 11,570 feet of Eocene to Recent marine and alluvial sediments, which overlie a basement complex of schist. The different formations within these sediments form the common limb of a faulted homocline that dips gently towards the southwest. This homocline is part of the deep, northwest trending structural basin known as the San Joaquin Basin.
10. According to information submitted by the Discharger, there are no significant faults which are active or potentially active on or immediately adjacent to the proposed injection site.
11. One minor subsurface, high angle fault, with approximately 20 feet of offset, is shown in prior publications to exist adjacent to the area underlying the injection site approximately 500 feet northeast of the proposed injection well. The presence of this fault is inferred from the distribution of oil in the subsurface sediments. The fault is not observed in wells which cross the inferred fault-plane.
12. The Discharger submitted information demonstrating that the entrapment of the oil is probably due to the pinching-out of discontinuous sand bodies in the subsurface. A past convention within the oil industry was to indicate the updip limit of oil accumulation by a fault, irregardless of the actual mechanism of oil entrapment. The publications which first illustrated this possible fault were published over 25 years ago and appear to follow this prior convention. The presence of a fault at this location thus appears to be a misconception based on negative evidence, which resulted in placing the fault on earlier maps as a matter of convenience to explain the occurrence of oil accumulations.
13. According to information submitted by the Discharger, there is presently one well within the radial area of influence of waste migration that is injecting into the equivalent injection disposal interval. The Texaco, W.I. No. 1 injection well is 640 feet south of the proposed injection well.

INJECTION WASTE STREAM

14. The waste stream consists of process waters generated from refinery units at the Plant operated by the Discharger and processed through the wastewater treatment plant. The refinery process units generating wastewater which is discharged to the wastewater treatment unit include: water softeners, boiler blowdown, cooling tower blowdown, lube plant waste water, crude oil process units, crude tanks, airblown asphalt plant, pump glands, product tanks, and other miscellaneous units associated with refinery operations.

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15. Typical daily discharge is expected to be approximately 0.08 mgd with a maximum of 0.10 mgd. Waste streams will be piped to a wastewater treatment unit. Treated and filtered wastewater will be contained in storage tanks at the facility, then piped to the injection well for disposal. The injection facility has a design service life of 20 years.

INJECTION ZONE

16. Disposal of waste through the proposed injection well will be into the marine Santa Margarita formation. Injection will be between an approximate subsurface interval of 3,715 feet and 4,150 feet. The actual injection interval will be determined based on the results of data obtained during the drilling of the well.
17. Portions of the basal Etchegoin, Chanac, and Santa Margarita formations are currently hydrocarbon producing in the Fruitvale Oil Field within one mile of the injection wells.
18. The basal portion of the Etchegoin formation, which averages 200 feet thick, consists of interbedded Pliocene age coarse-grained, micaceous sands and gray, micaceous shales. The Pliocene-Miocene age Chanac formation unconformably underlies the Etchegoin formation, averages 1,100 feet in thickness, and consists of fine- to coarse-grained sands with interbedded siltstones and claystones. The upper Miocene age Santa Margarita formation underlies the Chanac formation and averages 1,000 feet in thickness and consists of fine- to coarse-grained sands, with shales comprising the lower part of the unit. Below the Santa Margarita formation exists the Fruitvale Shale, approximately 1,500 feet thick.
19. The basal Etchegoin, Chanac, and Santa Margarita formations are currently utilized for injection of Class II wastewaters in the Fruitvale Oil Field as defined in the Federal Underground Injection Control (UIC) program and administered by the California Division of Oil and Gas. These formations have been administratively classified as exempt aquifers for the purpose of Class II injection (oilfield produced wastewaters) within the Fruitvale Oil Field in accordance with UIC criteria. Class II injection within the Fruitvale Oil Field has been a continuing practice since June 1958.
20. Analysis of waters from the proposed injection zone indicates it is of poor quality with a total dissolved solids concentration greater than 3,000 mg/l. The proposed injection zone is not an underground source of drinking water in accordance with State of California criteria contained in Regional Board Resolution No. 89-098 (see Finding Nos: 23-26).
21. Table I is a comparison between the water quality of the waste stream and the formations of the

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injection zone. The Discharger figures represent analyses obtained from samples taken between 30 September 1987 and 13 May 1988.

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Table I - Wastewater and formation water constituent levels.

Constituent mg/l; unless noted	Wastewater	SJR Margarita Fm.	Santa Standard	Title 22
<u>Inorganic Constituents</u>				
TDS		1909	5783	500.0
Conductivity (umhos/cm)	2651		8900	900
pH		8.5	7.7	
Arsenic		0.013	0.175	0.05
Barium		<0.5	0.55	1.0
Boron		0.35	7.0	
Cadmium		0.02	<0.01	0.01
Calcium		-	160	
Chloride	189.0		2625	250
Chromium (tot.)		<0.05	0.44	
Copper		0.02	2.3	1.00
Fluoride	<0.1		<0.1	4.0
Iron		-	42	0.35
Lead		0.04	1.32	0.05
Magnesium		-	49	
Manganese		-	1.5	0.05
Mercury (ug/l)		0.006	0.002	0.002
Potassium			24	
Selenium	0.001		<0.35	0.01
Sodium		-	1800	
Sulfate		515.0	15.0	250
Sulfite		-	191	
Vanadium	0.5		<0.35	
Zinc		0.08	3.06	5.0
<u>Organic Constituents</u>				
Benzene (ug/l)		24.0	6,431	1.0
Ethylbenzene (ug/l)	12.9		5,993	680.0
Phenol		0.15	5.9	
Toluene (ug/l)		697.0	5,947	100.0
Xylene (ug/l)		62.8	5,280	1,750.0
2,4-Dimethylphenol (ug/l)	-		411	

AQUIFER BENEFICIAL USE EVALUATION

22. The Regional Board on 26 May 1989 adopted Resolution No. 89-098, which defines waters which are considered Municipal and Domestic (MUN) sources of water.

23. Resolution No. 89-098 states:

"All surface and ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Boards with the exception of:

1. Surface and ground waters where:

- a. The total dissolved solids (TDS) exceed 3,000 mg/l (5,000 uS/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or
- b. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or
- c. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day."

and

"3. Ground waters:

- a. Where the aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations (CFR), Section 146.4, for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3;".

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24. The following information, supplied by the Discharger, addresses the application of the criteria discussed in Finding No. 23:
- a. The concentration of total dissolved solids within waters of the receiving zone is greater than 3,000 mg/l and is not reasonably expected to supply a public water system. The concentration of total dissolved solids (TDS) and chloride found within waters of the Santa Margarita formation exceeds the Secondary Drinking Water Standards of Title 22, California Code of Regulations by ten times (see Finding No. 21).
 - b. Portions of the Santa Margarita formation produce hydrocarbons in commercial quantities in the Fruitvale Oil Field within one mile of the injection wells.
 - c. Chemical analysis of produced waters from hydrocarbon producing wells (adjacent to the site) within the Santa Margarita formation, indicate that naturally occurring benzene, ethylbenzene, toluene, and xylene concentrations exceed Title 22 Standards for drinking water (see Finding No. 21).
 - d. The receiving aquifer is not currently serving as a source of drinking water, or an agricultural, municipal or industrial water supply.
 - e. The injection zone is not considered a future USDW based upon its stratigraphic location, poor water quality, and the availability of higher quality water on or near the surface. Waters within the Santa Margarita formations are not suitable for drinking water or for irrigation without treatment. The amortized cost of retrieving and treating the injection zone water is reported to be approximately \$1,300 per acre-foot. Currently, low salinity water from an on-site well at the Plant is available for \$30 per acre-foot.
 - f. Waters of the basal Etchegoin, Chanac, and Santa Margarita formations have been determined by the California Division of Oil and Gas (CDOG) not to be an underground source of drinking water, pursuant to 40 CFR, Part 146.4, for the purposes of Class II underground injection. Produced water injection into Class II injection wells regulated by the CDOG into the basal Etchegoin, Chanac, and Santa Margarita formations of the Fruitvale Oil Field has been a continuing practice since June 1958. This aquifer exemption extends a distance of one-quarter mile outside the administrative boundary of the Fruitvale Oil Field.
25. Based upon information submitted, the formation waters of the injection zone are not suitable, or potentially suitable, for municipal or domestic water supply in accordance with items 1a, 1b, and 3a in

Finding No. 23, and they do not have any demonstrated current or future beneficial uses.

26. On 26 April 1991, the Regional Board adopted Resolution No. 91-101, a determination that the injection zone is not a source, or potential source, of municipal or domestic supply per Regional Board Resolution No. 89-098.

INJECTION WELL DESIGN AND OPERATION

27. Design of the proposed injection wells is similar to existing injection wells currently operated by other nonhazardous dischargers in the area. These wells have been injecting concentrated waste solutions for over ten years. This information attests to the integrity of the well design as substantiated by annual mechanical integrity tests.
28. To prevent upward and lateral migration of wastewater, the annular space outside the long string casing will be cemented from the bottom of the wells to the ground surface. Surface casing will be cemented from a minimum depth of 500 feet to the surface and a minimum of 40 feet of conductor casing will be used for the wells, as shown in Attachment B, which is a part of this Order.
29. If the injection flow rate falls off, due to the clogging of interstitial pores, the Discharger anticipates the use of typical stimulation fluids, including bactericide, HCl, HF, and toluene with surfactant to increase the permeability of the receiving formation, in accordance with currently accepted reservoir engineering practices.
30. After 20 years of continuous injection at a rate that equals the maximum daily discharge, the waste front within the injection zone, where the injected liquids displace the formation waters, was calculated to extend a radial distance of 526 to 1,247 feet from the well bore. The dispersion front, where the injected liquids commingle with the formation waters, was calculated to extend radially outward 618 to 1,387 feet from the well bore.
31. Current formation pressure in the Santa Margarita formation is 1,685 psi. Following 20 years of continuous wastewater disposal, the formation pressure will be 1,762 psi at the well bore and 1,712 psi at a radial distance of 2,000 feet from the well bore, representing hydraulic increases of 177 feet and 62 feet respectively. Twenty years after cessation of injection, the formation pressures are expected to decrease to 1,687 psi, both adjacent to, and a radial distance of 2,000 feet from, the well bore, resulting in a net hydraulic head increase of 4.6 feet in the Santa Margarita formation.
32. The aforementioned changes in hydraulic head will be insufficient to cause migration of injected

wastewater into overlying useable ground waters in the absence of confinement. The proposed injection zone is overlain by adequate thicknesses of low permeability clay layers which should confine the wastewaters to the intended injection zone and preclude contamination of the useable ground waters. The proposed injection well will be constructed so as to preclude the migration of wastewaters around the well bores into overlying ground water zones. No adverse effects upon the shallow aquifers are anticipated as a result of wastewater injection.

OTHER CONSIDERATIONS

33. The CDOG has been notified of the Discharger's intent to drill the additional injection well. CDOG will act in a consulting capacity to the Board in overseeing the proper construction and testing of the wells. Also, since the Plant is within the administrative boundary of an oil field, the Discharger must also apply to the CDOG for a permit to drill the proposed injection well.

OTHER LEGAL REFERENCES

34. The Board on 25 July 1975 adopted the *Water Quality Control Plan for the Tulare Lake Basin (5D)* which contains water quality objectives. These requirements are consistent with that Plan.
35. These requirements are proposed to conform with the intent of the Underground Injection Control regulations administered by the U.S. Environmental Protection Agency.
36. The Board, acting as lead agency, made an environmental analysis, pursuant to the California Environmental Quality Act (CEQA) of Title 14, California Code of Regulations, and formulated a negative declaration. The project, as proposed, will not have a significant effect on the environment.
37. The Board has notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for this discharge.
38. The Board, in a public hearing, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that San Joaquin Refining Company, Inc., its agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. Discharge Prohibitions:

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1. The discharge of waste to surface water, surface water drainage courses, or usable ground water is prohibited.
2. The injection of any waste types not specified or constituents in excess of those specified within the context of these requirements is prohibited.
3. The injection of any hazardous waste is prohibited. This includes any waste constituents contained herein which may subsequently be listed by the U. S. Environmental Protection Agency or the California Department of Health Services as hazardous.
4. Injection between the outermost casing and the well bore is prohibited.

B. Discharge Specifications:

1. Neither the treatment nor discharge shall cause a pollution or nuisance as defined by the California Water Code, Section 13050. In the event of a pollution or nuisance, the Discharger shall take all responsible steps to minimize or correct any adverse impact on the environment resulting from noncompliance with the requirements.
2. The maximum daily discharge shall not exceed 100,000 gallons (0.10 mgd).
3. The discharge shall not exceed the following concentrations as measured by 30-day flow weighted analysis:

<u>Constituent</u>	<u>Monthly Concentration</u>
TDS	2,500 mg/l
Benzene	500 ug/l
Ethylbenzene	1,000 ug/l
<u>Constituent</u>	<u>Monthly Concentration</u>
Total Phenols	100 mg/l

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Toluene	3,000 ug/l
Xylenes	3,000 ug/l
Total Chromium	2.0 mg/l

4. The Discharger shall maintain casing and cement to prevent the movement of fluids into or between aquifers other than in the injection zone. The casing, tubing, liner, and cement used in the construction of the wells shall be maintained for the life of the well. The Discharger shall give advance notice to the Regional Board for Executive Officer approval of any planned changes in the construction of the injection wells. The following specifications apply to the injection wells:

Conductor casing:	40 feet of new 20 inch, steel
Surface casing:	500 feet of new 13-3/8 inch, grade H-40, 48#, steel casing
Long string casing:	4,300 feet of new 8-5/8 inch, grade H-40, 32#, steel casing extending downward from the surface
Tubing:	New 2-7/8 inch O.D., 6.5#, N-80, EU coupling from surface to approximately 3,680 feet.
Centralizers:	Will be installed on the long string casing at the rate of one per casing joint from the base of the casing to 200 feet above the injection zone, and one per every three casing joints from 200 feet above the injection zone to the base of the surface casing, and one every 250 feet inside the surface casing.

The Executive Officer may approve an alternative casing and completion program which is equivalent to, or better than, the above proposed specified program.

5. Injection must take place in the Santa Margarita zone through 2-7/8 inch O.D., 6.5#, H-40 tubing with a 2-7/8 inch x 8-5/8 inch hookwall retrievable packer set at approximately 3,670 feet. The tubing and packer shall be maintained in a manner which is compatible with said

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requirements to prevent the movement of fluids into or between other underground sources of drinking water. The tubing and packer shall be corrosion resistant and be of sufficient strength to resist wellbore pressure developed during the life of the well.

6. The minimum depth of injection shall be the top of the Santa Margarita formation at an approximate depth of 3,715 feet. The maximum depth of injection shall be the base of the Santa Margarita formation at an approximate depth of 4,150 feet.
7. Representative continuous cores of the confining zone and injection zone shall be taken during the drilling of the proposed injection well. The cores shall be analyzed to document the competency of the confining zone and the compatibility between the injection zone and injection fluid. Standard core descriptions shall include information on the porosity, permeability and capillary pressures for the confining zone (in both the horizontal and vertical directions) and the injection zone.
8. Following the drilling and completion of each injection well, technical reports are to be submitted by the Discharger to the Board for approval prior to the initiation of injection. The reports need to include the information, methods, results, evaluations, and/or actions as indicated below:
 - a. An evaluation of the mechanical integrity of the well.
 - b. Cement bond logs.
 - c. All geological and geophysical well logs, well data, core data (demonstrating the thickness and competency of the confining zone), capillary pressure data, and well histories with accompanying interpretation.
 - d. A formation fluid sample shall be analyzed for general minerals, trace elements, and priority pollutants. A waste stream analysis for general minerals, trace elements, and priority pollutants is to be performed within 30 days of initiation of injection.
 - e. The Executive Officer, or his qualified representative, has inspected or otherwise reviewed the new injection well construction and finds it is in compliance with the conditions of said requirements.
9. Injection wastewater shall be restricted to that produced by the Discharger from its refinery at

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the Plant in the Fruitvale Oil Field and identified in Finding No. 16.

10. Injection pressure at the wellhead shall not exceed a maximum which shall be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone. In no case shall injection pressure initiate fractures in the confining zone. The maximum injection pressure, as measured at the top of the perforated injection interval and at the wellhead, shall not exceed eighty percent (80%) of the pressure required to initiate fractures in either the injection zone or the confining layer during operation of the well. Prior to initiation of injection, the Discharger shall submit to the Executive Officer, for approval, all calculations and supporting data which will demonstrate the maximum allowable injection pressures (80% of fracture pressure), at the wellhead and at the top of the perforated injection interval, for the interval into which the discharge will be injected.
11. Construction and injection pressures shall be such that no passageways are developed which will permit the movement of wastes to a usable aquifer or to the surface.
12. An adequate spill management plan shall be submitted to the Executive Officer within 90 days of the adoption of these requirements.
13. Waste holding facilities shall be protected from inundation or washout which could occur as a result of a 100-year frequency, 24-hour duration storm.
14. Wastewater treatment, holding, distribution, and injection facilities shall be constructed of materials that are compatible with the waste and that shall prevent percolation or infiltration of waste to surface or ground water.
15. The pressure rating of all piping, valves, and appurtenant facilities shall meet or exceed the maximum anticipated injection pressure. This equipment must be maintained in a safe and leak-free condition.

C. Provisions:

1. The Discharger is allowed to engage in underground injection only within the guidelines of these requirements.
2. The Regional Board may, for cause or upon request from the Discharger, modify, revoke and reissue, or terminate these requirements.

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3. The Regional Board may also modify, revoke and reissue, or terminate these requirements in accordance with any amendments to the California Water Code if the amendments have applicability to the waste discharge requirements.
4. The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Discharger to achieve compliance with the conditions of said requirements. Proper operation and maintenance includes effective performance, adequate laboratory and process controls, including appropriate quality assurance procedures. Any remedial work on active, idle, or abandoned wells in the project area, necessary because of the disposal project, shall be the responsibility of the Discharger.
5. The Discharger shall furnish to the Executive Officer, within a time specified, any information which the Executive Officer may request to determine whether cause exists for modifying, revoking and reissuing, or terminating these requirements, or to determine compliance with said requirements. The Discharger shall also furnish to the Executive Officer, upon request, copies of records required to be kept by these said requirements.
6. The Discharger shall allow the Executive Officer, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:
 - a. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted; or where records are kept under the conditions of said requirements;
 - b. have access to, and copy at reasonable times, any records that are kept under the conditions of these said requirements;
 - c. inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under these said requirements; and
 - d. sample or monitor at reasonable times for the purposes of assuring requirement compliance on the disposal site.
7. The Discharger shall retain records and all monitoring information including all calibration and

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maintenance records and all original chart recordings for continuous monitoring instrumentation and copies of all reports required by said document for a period of at least five years from the date of the sample, measurement or report.

8. Forty-five days prior to abandonment of any disposal well, the Discharger shall file a technical report with the Executive Officer describing the methods and controls to be used for closing the well. The proposed abandonment procedure shall be approved by the Executive Officer prior to implementation. Well abandonment shall be accomplished under the supervision of a registered geologist, a registered petroleum engineer, or the Department of Conservation, Division of Oil and Gas. Within 60 days after plugging a well, the Discharger shall submit a report to the Regional Board. The report shall be certified as accurate by the person who supervised the plugging operation and shall consist of either:
 - a. A statement that the well was plugged in accordance with the plan previously submitted to the Board; or
 - b. if the actual plugging differed from the approved plan, a statement defining the actual plugging, and why the Board should approve such a deviation from the approved plan. Deviation from the previously approved plan may be cause for the Board to require the Discharger to replug the well.
9. The Discharger is required to maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in a manner consistent with Federal UIC regulations (contained in 40 CFR, Section 146.10) and regulations of the California Division of Oil and Gas. Evidence of the financial responsibility mechanism shall be provided to the Board within **90 days** following adoption of these requirements, and if required, shall be updated periodically upon request of the Board.
10. The injection wells must have and maintain mechanical integrity.
11. The Discharger shall submit technical reports as directed by the Executive Officer.
12. The Discharger shall comply with the attached Monitoring and Reporting Program No. 91-132, which is hereby incorporated into this Order.
13. The Discharger shall comply with the applicable Standard Provisions and Reporting Requirements, dated 1 March 1991, which are a part of this Order.

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14. The Discharger shall report promptly to the Board any material change or proposed change in the character, location, volume, or rate of the discharge.
15. The owner or operator must notify the Board by certified mail of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code, naming the owner or operator as debtor, within 10 business days after the commencement of such proceedings. A guarantor or a corporate guarantee must make such a notification if he is named as debtor, as required under the terms of the guarantee.
16. In the event of any change in control or ownership of land, mineral rights, or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Board.
17. A copy of this order shall be kept at the facility so as to be available at all times to operating personnel.
18. This Order does not constitute a license or permit, neither does it authorize the commission of any act resulting in injury to the property of another, nor does it protect the Discharger from his liabilities under federal, state, or local laws.

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I, WILLIAM H. CROOKS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 28 June 1991.

WILLIAM H. CROOKS, Executive Officer

DSJ:fmc: 28 June 1991